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U. S. DEPARTMENT OF AGRICULTURE.

REPORT

OF

THE BOTANIST

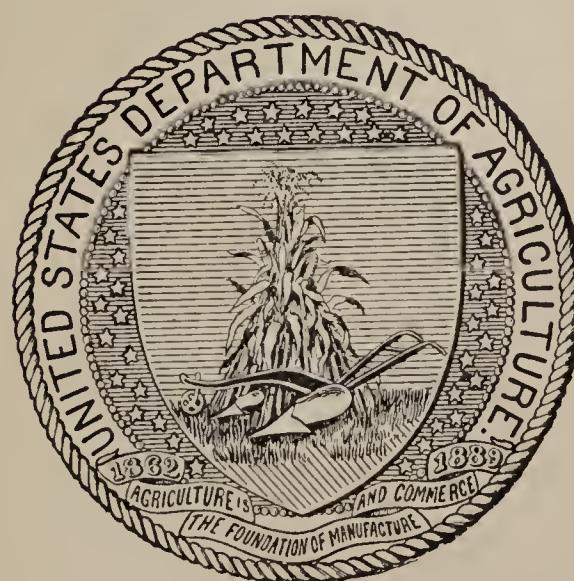
FOR

1900.

BY

FREDERICK V. COVILLE.

[FROM ANNUAL REPORTS, DEPARTMENT OF AGRICULTURE.]



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REPORT OF THE BOTANIST.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF BOTANY,
Washington, D. C., October 12, 1900.

SIR: I have the honor to transmit herewith my eighth annual report as Botanist of the Department of Agriculture, covering the year ending June 30, 1900.

Respectfully,

FREDERICK V. COVILLE,
Botanist.

Hon. JAMES WILSON, *Secretary.*

WORK OF THE YEAR.

PLANT HOUSE.

The construction of the plant house, authorized in the appropriation for the fiscal year 1899, was completed and the building ready for experimentation in October, 1899. This house has been particularly useful in connection with our pure-seed investigations and our plant-introduction work. All our germination tests have been conducted in the building, and the head house has been used also as a photographic laboratory. In the greenhouse have been grown a stock of different species of rubber-producing plants and a number of other seeds and plants introduced from foreign countries, which it was desirable to propagate before they were distributed. The excellent facilities afforded by this plant house and the important service it has rendered in our investigations amply demonstrate the wisdom of the appropriation for building it.

POTOMAC FLATS.

The testing garden on the Potomac Flats, the use of which by the Department of Agriculture was authorized by Congressional action, as detailed in my last annual report, has been an important addition to the experimental facilities of the Division. During the summer of 1899 and the following winter the ground was several times plowed and harrowed in order to keep the weeds in check and kill the cutworms. In the spring of the present year the garden was fenced and an additional plowing and harrowing brought the soil into excellent condition for experimental work.

Of the total area of 25 acres, 12 acres were allotted to the uses of the Division of Botany, 5 to the Division of Agrostology, 5 to the Division of Vegetable Physiology and Pathology, 2 to the Division of Chemistry, and 1 to the Division of Pomology. The area kept under experimental

cultivation by the Division of Botany was devoted chiefly to the cultivation of a large series of plants introduced from foreign countries through the Section of Seed and Plant Introduction, to field tests in connection with pure seed investigations, and to the experimental cultivation of a series of native and imported hemp. The results of these experiments will be duly prepared for publication later. For the present, it may be said that these grounds have enabled our force of investigators to check their laboratory experiments in a manner which was impossible without a field for outdoor experimentation. Several of the experiments have been so successful that any one of them would have more than paid for the entire expense of the maintenance of the garden. Even these early results clearly indicate that the Department should maintain somewhere, conveniently accessible to the main buildings, a permanent experimental garden.

POISONOUS PLANTS.

During the winter of 1899-1900 the State board of sheep commissioners of Montana made representation to the Department of the large losses of live stock on the great unfenced ranges of that State, which were supposed to be due to poisonous plants, and these representations were accompanied by an appeal to the Department to send its experts on this subject to Montana to investigate the matter and prepare reports which would enable the stockmen to control their losses. So great was the loss and so urgent was the necessity for an investigation that the stockmen of the State voluntarily agreed to advance the entire cost. Fortunately, the Department was enabled to assume these expenses, owing to the fact that a portion of the appropriation for botanical work for the fiscal year 1901 had been made immediately available. Mr. V. K. Chesnut and Dr. E. V. Wilcox, the latter temporarily transferred to the Division of Botany from the Office of Experiment Stations, through the courtesy of Dr. A. C. True, Director of that Office, were detailed to field work on the first of May and remained in the field for two and three months, respectively, making a thorough investigation of the plants on the open ranges and determining by physiological tests the nature and action of the poisonous principles. They also ascertained a remedy, which, for some of the most important of the poisonous plants, is effective and easy of application. The report of these investigations, which it is expected will be ready for publication early in the coming winter, will enable the stockmen of Montana, first of all, to know and avoid the poisonous species, and, secondly, if stock have accidentally been poisoned, to apply in some cases an effective remedy. The satisfactory results of this investigation are due in large part to the cooperation of the Montana Agricultural Experiment Station, the State veterinarian, and the State board of sheep commissioners. Especially do I wish to acknowledge the active cooperation, assistance, and courtesy of Hon. T. C. Power, chairman of that board.

SECTION OF SEED AND PLANT INTRODUCTION.

The office facilities for receiving and distributing foreign importations have been materially improved during the year. The warehouse has been equipped with suitable cases easy of access and so constructed as to amply protect the contents, while at the same time permitting their proper classification. The records of receipt and dis-

tribution, which in the interest of systematizing the introduction work it is necessary to maintain in a manner suitable for precise and permanent consultation, have been simplified to a considerable extent—just so far, indeed, as simplification is compatible with the primary purpose of the records. The accumulation of work on hand in the early part of the year made it necessary to employ labor additional to the regular force. This extra work has now been completed and the office force has again been reduced to its normal size. The principal cause of the accumulation of work was the very large number of importations made in preceding years. It has now been shown by experience that to secure the best results the energies of the explorers and field agents should be directed to the securing of fewer importations with more complete information regarding them, rather than to a large number of importations with necessarily scantier information.

At the request of the Chemist of the Department the purchase and distribution of sugar-beet and sorghum seeds, heretofore carried on by the Division of Chemistry, has been turned over to the Division of Botany, and is conducted along with the plant-introduction and distribution work. This is undoubtedly an economy, as the facilities for handling large quantities of seeds are not now duplicated, as they were under the old system. The amount of these seeds purchased is still determined by the Secretary on the recommendation of the Chemist. The seeds are sent to lists of experimenters furnished by the Chemist, and the working up of results is still carried on by him as formerly.

It became clear during the preceding years that some of the most valuable plants for introduction into the United States were in the hands of foreign botanical gardens which did not sell seeds or plants, but which were willing to make exchanges for them. The Department had at that time no available exchange material, but during the past year such material has been collected, particularly in the arid region of the Southwest, and while no full catalogue has as yet been published, photographs, accompanied by accounts of the more interesting plants, were put in the hands of the foreign agents of the Department, and some very valuable exchanges were in this way secured. The results of this year's exchange work indicate that this is an important means of securing valuable introductions.

One of the departures contemplated when the plant-introduction work was inaugurated was the redistribution of importations which proved to be successful. In accordance with this idea the Khiva winter muskmelon from Turkestan, which proved to be so successful under irrigation in the warmer portions of the arid West, was redistributed last year. And similarly, it was determined that Turkestan alfalfa, which has proved far superior to American alfalfa in withstanding freezing in the arid regions, should be more widely distributed. With this view, contracts were made last spring with several Western growers, and when this American-grown stock shall have been delivered it will be distributed far more extensively than was possible with the original importation. The Kiushu rice, which has proved so remarkably successful in Louisiana, was redistributed last spring. The distributions already made, together with direct importations of this rice by private parties during the past season, has established this product so widely and successfully that it will doubtless be unnecessary for the Department to distribute it further.

In the introduction of cereals special attention has been paid during the past year to macaroni and Hungarian wheats. The European

macaronis, which are now largely imported into the United States, are made from special varieties of hard wheats which we have not heretofore grown commercially in the United States. Several of these macaroni wheats have, however, been secured during the past year from Russia and from Algeria, and the experiments with these varieties, if successful (and there is every promise of their success), will furnish the basis of a large development of the macaroni-manufacturing industry in the United States, and consequently for the production of macaroni wheats both for home trade and for export, in those parts of the country to which the experiments now in progress show them to be adapted. Importations have also been made of the winter wheats used in the manufacture of the Hungarian export flours which have a high reputation the world over. If these wheats are as successful in the United States as they are in Hungary a large extension will be made in the area in which our highest-priced bread wheats can be grown, as the wheats that heretofore have filled this description have been spring wheats, the area of successful cultivation of which has been comparatively limited.

The determination of the Department to establish the culture of the date in Arizona, in cooperation with the Arizona Agricultural Experiment Station, has been prosecuted successfully during the year. Mr. W. T. Swingle, after a preliminary trip to California and Arizona to ascertain the precise facilities for the receipt and care of the dates after reaching this country, then proceeded to Algeria, secured and packed the date suckers, arrangements for which had been previously made by him, and also secured a large number of additional date plants. All these were forwarded to Washington, D. C., and soon after the end of the fiscal year 1900 were shipped through to Arizona, disinfected, and properly planted. There is, therefore, now established at a suitable spot in Arizona and under the joint administration of the Arizona experiment station and the Department of Agriculture a date garden in which are growing successfully about 500 plants of the best varieties of dates known in the Mediterranean region. As these plants develop suckers a distribution of stock will be made to individuals in the Southwest who are properly situated for handling this crop.

It is gratifying to learn that the fig-fertilizing insect secured in Asia Minor for the Division of Entomology by Mr. W. T. Swingle while engaged in the plant-introduction work and successfully established in California by that Division promises, as reported by the Entomologist, to revolutionize the fig industry of that State.

The Department's investigation of the cultivation of Bermuda lily bulbs in the United States was continued during the year, Mr. M. G. Kains making two visits to the Bermudas and to various points in the Southern States for that purpose. These experiments have not yet sufficiently progressed to warrant their full publication, but it may be stated that at the present time there is excellent promise that the industry may be established at favorable localities in the Southern States.

An opportunity having been afforded the Department of Agriculture to make an examination of the agricultural crops of the upper Yangtze Valley in China, particularly in the Province of Szechuan, arrangements were made in the spring by which Mr. G. D. Brill, an American agriculturist who for two years has been resident at Wachang, was to proceed up the Yangtze River to secure for introduction into the United States some of the valuable agricultural products of that

country. The recent disturbances in China have interfered to some extent with this work, and we are as yet uncertain what results have been accomplished.

The expedition conducted at the expense of Hon. Barbour Lathrop, in which Mr. Lathrop and Mr. David G. Fairchild bore honorary commissions from the Department of Agriculture, has resulted in the introduction of some very promising plants from various parts of the world, particularly Egypt, and in the securing of a large amount of valuable information regarding possible introductions, which has courteously been placed at the disposal of the Department of Agriculture.

SEED LABORATORY.

In addition to the testing of the seeds included in the Congressional distribution, the assistant in charge of the seed laboratory has conducted an investigation of certain important commercial seeds which are frequently found on the market in a defective condition, the buyers of which suffer losses aggregating large amounts. Special attention was paid to crimson clover, red clover, and beardless brome grass.

Special studies were made also in the technique of the artificial germination of seeds. Heretofore we have been working on the basis of the rules adopted by the European seed-control stations, which require that most of the testing be done at a constant temperature of 20° C. Our experience has been that this temperature is not always satisfactory. Contradictory results have been obtained with Kentucky blue grass, lettuce, tobacco, and vine seeds, and it has been necessary to conduct careful tests in order to settle finally on the best methods of germinating these seeds. The results of these investigations will be given in reports to be submitted hereafter for publication.

TRIAL GROUNDS.

In addition to the field tests for trueness to name of the seeds included in the Congressional distribution, the trial grounds at Kensington, Md., have been used this year to continue and verify the tests of the lettuces offered by American seedsmen, and to make field trials of a few other novelties or interesting varieties in the line of vegetables. A discussion of the tests for trueness to name will be taken up later in this report. The testing garden of the Potomac Flats having now been in operation a year, and its utility and convenience, as well as the fertility of the soil, having been demonstrated, the trials heretofore conducted at Kensington will be transferred in the spring of 1901 to the testing gardens on the Potomac Flats.

PORTO RICO.

As pointed out in the last annual report, the Division of Botany is receiving a large number of inquiries about the cultivated plants of the Tropics. Many of these inquiries relate to the possibilities of economic plants in Porto Rico. A large part of the inquiries come from men desirous of making investments in Porto Rican agricultural lands, with a view to their early and active development. This widespread and active interest of Americans give promise of a revolution in tropical agriculture similar to that which has taken place in the last half century in temperate agriculture. With this view

of the importance of assisting the people of the United States to an early knowledge of the conditions in Porto Rico, it was decided to send an economic botanist to the island to secure the data of which the people of the United States were in search. Mr. O. F. Cook, assisted by Mr. G. N. Collins, spent most of the months of November and December, 1899, in Porto Rico, and secured a large amount of valuable information which, together with other information published in places not accessible to the American public, has been elaborated into a comprehensive and well-illustrated report. This report was completed at the end of the fiscal year and has since been submitted for publication.

FIBER INVESTIGATIONS.

In September and October, 1899, a trip was taken through the Southern States to investigate the merits of the African Limbless cotton, which had been planted at different localities under the supervision of the Department of Agriculture. Egyptian cotton grown in Texas from seed originally imported by the Department was also made the subject of special investigation, and, incidentally, several leading upland varieties received some attention. Circular No. 26, entitled "Egyptian cotton in the United States," was prepared chiefly from data obtained in this investigation. The value of the African Limbless cotton, which is a variety of fair merit, was found to have been extravagantly overstated by its promoters. In the spring of 1900 experiments were instituted at several points in the Carolinas and also on the trial grounds on the Potomac Flats in the cultivation of hemp. These experiments are under the immediate direction of Mr. S. S. Boyce, and are designed to indicate the relative merits of different varieties, different soils and locations, and different fertilizers.

TESTING THE SEEDS OF THE CONGRESSIONAL DISTRIBUTION.

The Division of Botany has been charged with the duty of testing each year the seeds purchased by the Department for Congressional distribution. These tests are for the purpose of ascertaining whether the seeds come up to the contract requirements. The tests are for purity, germination, and trueness to name. The tests for purity consist in separating from the good seeds all dirt, sticks, stones, dust, chaff, insects, weed seeds, broken seeds, and other foreign matter. The impurities are weighed, and a comparison of their weight with the weight of the whole sample gives the percentage of purity. The weed seeds contained in the sample are identified, and if any seeds of certain objectionable weeds named in the contract are found, the sample is rejected. The Department reserves the right to reject any seed falling below the prescribed standards in purity, or, if it falls slightly below the standards and the impurities are not objectionable, the seed may be accepted, the Department deducting in payment therefor a sum proportionate to the difference between the standard and the purity of the sample. The average of the standards of purity named in the last contract is 98.3 per cent. The average of the purity of all the seeds distributed last year was 97.3. This is considered a highly creditable showing.

The test for germination is conducted by counting out several sets of 100 or 200 plump seeds from a sample and germinating them both in a germinating apparatus and in soil. On the basis of the percentage

of germination thus ascertained, as compared with the standards of germination prescribed in the contract for each kind of seed distributed, the Department accepts or rejects the seeds, reserving the privilege of accepting a lot that goes slightly below standard, with a provision for a drawback, precisely as in the case of purity. The average of the lower limit in the germination standards for the past year was 86.2 per cent. The average germination of all the seeds distributed was 91.4 per cent. The seeds distributed therefore averaged in germination 5.2 per cent higher than a standard which has been considered by many seedsmen unnecessarily high.

The third test—that for trueness to name, or genuineness—is conducted in the field. Samples of the seeds, under the names under which they are distributed, are planted on our trial grounds along with varieties of authentic samples of the same seed secured by purchase from reliable seedsmen. All the plants that come from the test sample are grown to maturity, and those true to name as well as those not true to name are counted and the percentage of trueness to name ascertained. It is evident from the time consumed in making these field tests that they can not be made until after the seeds have been distributed, and it is chiefly in this direction that the seeds purchased by the Department have in the past proved to be defective. No standard of genuineness has heretofore been set by the Department. It will therefore be a matter of general interest to announce that the Secretary of Agriculture, since the end of the fiscal year, has established the following standard:

The standard of trueness to name of each variety shall be the average of the percentage of trueness to name in not less than five commercial samples of the same variety purchased under the direction of the Secretary of Agriculture in the open market from five or more reliable seed houses, and the Secretary of Agriculture shall be the sole judge of the results of the tests reported by the officer or officers charged therewith by him. Not less than 100 plants from each lot of the seeds furnished by the contractor shall constitute a test.

SCIENTIFIC AIDS.

The plan inaugurated by the authority of the Secretary of Agriculture early in the fiscal year to offer positions as scientific aids at a small salary to graduates of the agricultural colleges who had shown special qualification for investigation work has been followed by this Division to the extent of three appointments of this character. From the experience thus gained, it is clear that if the policy of selecting and appointing scientific aids is followed with discretion a valuable corps of young experimenters will be trained up who will be suitable for positions in agricultural colleges or other similar institutions, or for such positions as may offer themselves in this Department. It is not, however, to the interest of the Department to appoint as a scientific aid a man whose work requires constant and detailed supervision. A scientific aid should be capable of conducting an investigation with only a moderate amount of direction from the officer to whom he is responsible.

FOREST RESERVE GRAZING.

The Secretary of the Interior, in consideration of the agricultural bearing of the controverted question of sheep grazing within the forest reserves, requested the Secretary of Agriculture to make an investigation of this problem, and the chief of the Division of Forestry, who was intrusted with the investigation, invited the cooperation of the Botanist in a personal examination of the Arizona reserves, in which

the controversy was most acute. The necessary field work was carried on in May and June, 1900. It is confidently believed that the carrying out of the recommendations that will follow this investigation will result in protecting the industries of Arizona without destroying her natural resources.

PUBLICATIONS.

The publications issued during the year, in addition to the reprints of some of the earlier reports, are as follows:

BULLETINS.

No. 22, The Present Status of Rice Culture in the United States, by S. A. Knapp, issued December, 1899. This publication gives a description of the new system of rice culture, particularly as now reaching perfection in Louisiana and Texas, by which through a process of controlling the water supply of the rice fields and thereby permitting the use of machinery for plowing, harvesting, and other important operations, the cost of production of rice has been so much reduced that this country can compete successfully with rice produced through cheap hand labor in the Tropics.

No. 23, Russian Cereals Adapted for Cultivation in the United States, by Mark Alfred Carleton, issued February, 1900. This bulletin is a detailed report, primarily intended for use of experimenters, on the varieties of wheats secured by Mr. Carleton in Russia in 1898 and 1899. It gives full details of the characteristics of these wheats in Russia and the conditions under which they are grown there, and makes suggestions as to the places best suited to their trial in the United States and the best methods of handling them.

No. 24, The Germination of Seeds as Affected by Certain Chemical Fertilizers, by Gilbert H. Hicks, issued April, 1900. This is a report on certain experiments in which field and vegetable seeds of different sorts were sown in soil in contact with fertilizers of different kinds. The results of the experiments showed that some of these fertilizers were distinctly injurious to the germination of seeds and in certain cases would have destroyed almost the entire crop. The conclusion drawn from the investigation is that these fertilizers should be applied to the soil in such a way as not to come into direct contact with the seeds.

CIRCULARS.

No. 18, Crimson Clover Seed, by A. J. Pieters, issued August, 1899. The publication gives the result of an examination of a large number of samples of crimson clover, and shows that the seed of this plant, which has come into extensive use recently for forage and green fertilizer, is found upon the market in an exceedingly variable condition. Many samples are of high germination and free from weed seeds, but some of the samples tested failed entirely to germinate and some of them were badly adulterated. The result of the investigation was a recommendation to farmers that before planting crimson clover seed extensively a sample lot, drawn from what they proposed to sow, should be carefully tested either by the farmer himself, by some experiment station, or by the Department of Agriculture.

No. 19, Hop Cultivation in Bohemia, by David G. Fairchild, issued November, 1899. This is an account, by one of the agricultural

explorers of the Department, of the culture of the high-grade hops of Saaz and Auscha, the two most noted hop-growing districts of Bohemia. It contains much useful information for those experimenting with the introduction of these hops into the United States.

No. 20, Horse-radish Culture in Bohemia, by David G. Fairchild, issued January, 1900. This contains an account of the culture of the Maliner horse-radish of Bohemia, where the culture of this plant has reached a high state of perfection and where specially selected varieties have been developed. Some of these promise to be useful introductions for the United States.

No. 21, Yams in the West Indies, by David G. Fairchild, issued January, 1900. This circular contains an account of the cultivation of some of the best varieties of yams in different parts of the West Indies. It was issued not only to show what might be done in some of the tropical dependencies of the United States, but also to call attention to these vegetables as possible additions to the import market of the United States.

No. 22, Bur, or Globe, Artichokes, by Walter T. Swingle and David G. Fairchild, issued February, 1900. An account of the globe artichoke, which forms one of the most delicious vegetables in southern Europe, but the use of which in the United States is as yet very limited. It is believed that some of the best varieties of this vegetable will become important additions to the truck-growing industries of the south Atlantic States.

No. 23, The Lebbek or Siris Tree, by David G. Fairchild, issued March, 1900. An account of the lebbek tree, which is used largely for shade and as a protection to irrigation ditches in Egypt and other tropical countries. It is suitable for introduction into the warmer parts of the United States where only slight frosts occur.

No. 24, Red Clover Seed, by A. J. Pieters, issued March, 1900. This is an account of some of the ordinary defects of red clover seed, with instructions to the farming community how to ascertain the quality of the seed before it is planted.

No. 25, The Seed of Beardless Brome Grass, by A. J. Pieters, issued April, 1900. The introduction of this grass into the semiarid portions of the United States has shown it to be a forage plant of very great value, and the demand for the seed has enormously increased within the past few years. It is found, however, from testing a large number of samples, that most of the brome-grass seed imported from foreign countries and offered for sale in the United States is low in germination or contains a large amount of injurious weed seeds, or has both these defects. This circular brings out the important fact that the brome-grass seed produced in the United States is of far better quality than the imported product.

No. 26, Egyptian Cotton in the United States, by Lyster H. Dewey, issued April, 1900. This publication points out the value of the Egyptian cotton imported into the United States, which varies from \$3,000,000 to \$5,000,000 per year, gives an account of experiments with the varieties already tried in the United States, and compares the climatic and other cultural conditions of the American districts with those of the Nile region.

No. 27, Canada Thistle, by Lyster H. Dewey, issued June, 1900. This is an account of the damage caused by the Canada thistle, with information as to the best method of eradicating the pest.

REPORT.

Report of the Botanist for 1899, by Frederick V. Coville, issued January, 1900. The regular administrative report of the work of the Division of Botany.

INVENTORIES OF SEEDS AND PLANTS.

No. 2, Foreign Seeds and Plants Imported by the Section of Seed and Plant Introduction, Nos. 1001 to 1900. This includes a part of the importations brought by Prof. N. E. Hansen from Russia and central Asia, and some material secured by Mr. Walter T. Swingle in various parts of Europe.

No. 5, Foreign Seeds and Plants Imported by the Department of Agriculture and for Distribution by the Section of Seed and Plant Introduction, Nos. 1901 to 2700. This is chiefly a continuation of the list of vegetables, fruits, forage plants, and ornamentals procured by Mr. Walter T. Swingle in France, Italy, and Algeria.

No. 6, Foreign Seeds and Plants Collected in Austria, Italy, and Egypt by Hon. Barbour Lathrop and Mr. David G. Fairchild for the Section of Seed and Plant Introduction. This contains several important vegetables and cottons, a seedless raisin grape, and several other plants chiefly useful for forage or green fertilizer.

PAPER PREPARED FOR THE DEPARTMENT YEARBOOK FOR 1899.

Seed Selling, Seed Growing, and Seed Testing, by A. J. Pieters. An account of the history and development of the seed industry in the United States, with a special portion devoted to the modern methods of testing seeds.

CONTRIBUTIONS FROM THE U. S. NATIONAL HERBARIUM, VOL. V, NO. 4.

Studies of Mexican and Central American Plants—No. 2, by J. N. Rose; Two New Species of Plants from the Northwestern United States, by L. F. Henderson; *Hesperogenia*, a New Genus of Umbelliferae from Mount Rainier, by J. M. Coulter and J. N. Rose; Three New Species of *Tradescantia* from the United States, by J. N. Rose; *Treleasea*, a New Genus of Commelinaceae, by J. N. Rose; Notes on Useful Plants of Mexico, by J. N. Rose. The last article was issued also as a separate.

PLANS FOR THE FISCAL YEAR 1901.

INVESTIGATIONS IN TROPICAL BOTANY.

The question of investing money in agricultural enterprises in our tropical dependencies is attracting a great deal of attention, and we are deluged with requests for information on the subject. Investigations in the field are necessary to obtain reliable information as to the possibilities of the cultivation in Porto Rico and the Hawaiian Islands of vanilla, cacao, india rubber, and other tropical products that we now import from other countries. It is also desirable to inquire into the possibility of extending and improving the cultivation of coffee, bananas, and other suitable products. The special agent for tropical agriculture will be engaged in compiling the scattered information on the cultivation of tropical plants, selecting that which is most authen-

tic, and putting it into form for information to the public and for experimenters. It is important that an appropriation be secured which will enable us to follow up this phase of our investigations with actual field experience of such a character as to render the additional information which can be secured only in this way available for public use.

DETERIORATION OF GRAIN IN OCEAN TRANSIT.

About three years ago protests began to be received from European countries against the condition of some of the grain, particularly corn, that was being received from the United States. A preliminary investigation of the subject by the Department of Agriculture has brought out the fact that the problem must receive a thorough investigation in order to ascertain the causes of the deterioration of export grain, particularly in ocean transit, and to devise means for preventing losses from those causes. The points requiring consideration are proper stowage, ventilation of vessels, prompt unloading, the condition of the grain with respect to cleanliness and moisture content, and the drying of grain before shipment when necessary. The expenditure of an amount of money sufficient to make an exhaustive investigation of these questions would be amply repaid by the commercial advantages to be derived therefrom.

